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INNOVATIVE RESEARCH FOR A SUSTAINABLE FUTURE

Lick Run: Green Infrastructure in Cincinnati and Beyond

Green infrastructure, including the rain garden in St. Francis Apartments pictured on the right, can prevent combined sewer overflows like the one pictured to the far right.

Green Infrastructure

By capturing and redistributing rain water or runoff in plant-soil systems such as green roofs, rain gardens or swales, green infrastructure restores natural hydrologic cycles and reduces runoff from overburdened gray infrastructure. Targeted ecosystem restoration, contaminant filtration, possible economic and social benefits, and the provision of ecosystem services are additional benefits of green infrastructure. Using this new way of looking at urban renewal, EPA researchers use an environmental driver to reduce or eliminate combined sewer overflows with green infrastructure as one management approach, with the knowledge that functional greenspace can comprehensively address social, economic and environmental issues by presenting a focal point for re-development.

In April 2011, EPA released its Strategic Agenda to Protect Waters and Build More Livable Communities through Green Infrastructure to help communities implement green infrastructure approaches. The Lick Run project in Cincinnati is one example of EPA researchers at work around the country to determine how green infrastructure fits into communities to achieve environmental management goals in economical, socially acceptable ways.

Project Sites and Goals

For the last 100 years, the Lick Run, a stream, was put into a pipe that combines storm flows and sewage. During even small storms, the pipe spills its polluted mixture into the Mill Creek where downstream water quality is compromised.

A recent goal of the U.S. Environmental Protection Agency and the Metropolitan Sewer District of Greater Cincinnati is to remove stormwater discharge from the pipe and return the Lick Run to a state that flows freely to the Mill Creek. As part of this goal, EPA researchers are collaborating with the local sewer district to monitor and adjust several green infrastructure early success projects that are designed to take stormwater out of the combined sewer and put it to good use elsewhere.

The first project is at Quebec Heights, a small tributary to Lick Run. The project examines how sealing normally open combined sewer pipes and routing storm flow to a restored channel may help to eliminate combined sewer overflows and prevent a great deal of pollution in U.S. streams, lakes and rivers.

The second project uses a pair of rain gardens installed at the St. Francis Apartments. The rain gardens are designed to reduce the amount of stormwater runoff reaching the Lick Run sewer system, and to improve water quality by filtering parking lot runoff.

Other projects address how amphibians might respond to different extents of green infrastructure, how culverted streams process nutrients like nitrogen, and how parking lots can be built to absorb stormwater runoff.

Although similar reconstruction projects and stormwater best management practices have been installed throughout the U.S., little supporting monitoring data are being collected to evaluate the efficiency of these practices, especially in terms of reducing stormwater runoff and improving water quality. EPA researchers are taking a more careful look at how soils and underlying geology influence the effectiveness of these practices and affect water cycles in the local area. Practical hydrologic monitoring of the Quebec Heights and St. Francis sites will examine these issues and document the benefits of these stormwater management practices along with their costs and services provided.

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For communities considering adoption of management practices like these, EPA economists are researching how to evaluate the linked social and economic benefits of green infrastructure.

Objectives and Questions

Several objectives will be addressed at Quebec Heights and St. Francis Apartments before and after stream reconstruction and best management practice implementation:

1. Characterize how each practice moves stormwater around the urban hydrologic cycle, and determine if there are conditions under which these practices work better or worse.
2. Document the dynamic and chemical quality of stormwater that infiltrates and runs off the sites.

A sewer pipe runs the length of a small stream channel that is a tributary to the Lick Run reach in Quebec Heights. Like most small combined sewers, this pipe collects both sanitary and stormwater flows from the adjacent residential neighborhoods. The Metropolitan Sewer District plans to reconstruct parts of the pipe and otherwise seal off the inlets that allow stormwater to enter the pipe. The stormwater will instead be sent to a restored stream reach where stormwater runoff will once again flow in a natural channel. The reconstruction is intended to reduce stormwater flows within the sewer pipe, improve habitat for aquatic biota in the channel, and enhance the aesthetics of the area.

Similarly, the St. Francis Apartments wishes to limit its contribution to the local combined sewer by moving stormwater into two linked rain gardens. The performance of these approaches must be better understood to manage the risk of combined sewer overflows, water quality issues, and flooding in this densely developed urban area.

The socioeconomic side of the study will develop a cost-benefit analysis framework for evaluating and informing decision makers about the anticipated benefits of alternate gray and green infrastructure approaches to stormwater management. Some questions to be addressed in this context include:

1. What data must be available to carry out such a study?
2. How do we measure the benefits and costs of green implementation?

Research Approach

By teaming up with the local sewer district, EPA researchers have a practical research forum with which to monitor these practices and make generalizable recommendations on how these systems work and don't work, and how they might be adapted to other areas in the U.S. In order to do this work, the EPA collaborates with local, state, and other federal agencies, including the United States Geological Survey.

To aid decision makers considering choices between green or gray infrastructure, the University of Cincinnati Economics Center in collaboration with EPA researchers will develop a cost-benefit framework consisting of socioeconomic impacts in the project area and will collect relevant data from communities like Lick Run. Economic metrics that can be investigated include investment, employment and changes in property value. Researchers will identify direct and indirect costs, benefits and impacts of the green infrastructure installation. The work will also identify the geographic scope of project impacts, and potential unintended consequences of the project.

Collaboration and Outreach

EPA researchers collaborate with local, state and federal agencies to conduct this practical research. Since the projects are highly visible, they offer numerous opportunities to inform visitors of the efforts of the EPA and its partners in making sure that the requirements of the Clean Water Act are met while promoting social benefits and economic stability.

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A rain garden in St. Francis Apartments is pictured below.